

Heritability of Clover Root Curculio Resistance in Alfalfa

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The clover root curculio (CRC), *Sitona hispidulus* F., is a weevil pest of alfalfa, *Medicago sativa* L., throughout most of North America. Larval feeding on nodules and roots has been shown to decrease yield and persistence in alfalfa stands as well as to provide an entry for root diseases. The evaluation of plant introductions by Presho (1975) showed significant variation in CRC resistance among lines, and Byers et al. (1996) found that progeny of plant introductions selected for resistance also had significantly less CRC feeding damage. No additional breeding for resistance has been reported nor are any CRC resistant cultivars being marketed.

The purpose of this study is to determine the heritability of CRC resistance and by doing so determine the best selection method for developing resistant cultivars. In 2003, 3 replications of 75 half-sib progenies from each of two cultivars previously unselected for CRC resistance, Seedway 9558 and Oneida Ultra, were planted into a field nursery. A replicated nursery also was planted with full-sib progenies from plants selected for CRC resistance or susceptibility from the same two populations. In 2005, each plant was given a CRC rating of 1 to 5 (1=no feeding damage on roots, 5=severe feeding damage) and also a size rating (1=small plant, 3=large). Half-sib means of CRC ratings ranged from 2.29 to 3.71 in the Seedway 9558 population and from 2.32 to 3.54 in the Oneida Ultra population. Heritability estimates for the Seedway 9558 and Oneida Ultra populations are 0.56 ± 0.33 and 0.08 ± 0.47 , respectively. Although neither of these heritability estimates are significant, an ANOVA showed the variability among half-sibs to be significant ($P < 0.05$) in the Seedway 9558 population. No significant phenotypic correlation was found between CRC resistance and plant size for the Seedway 9558 or Oneida Ultra populations [$r = 0.08$ (N=75) and -0.22 (N=73), respectively]. Entry means for CRC ranged from 2.55 to 3.57 in the full-sib nursery. Variability among entries was significant for CRC rating ($P < 0.01$) and for plant size ($P < 0.05$) though there was no significant correlation between the traits [$r = -0.30$ (N=24)]. The standard unit heritability regressing full-sib progeny means on their mid-parent means was 0.59 ± 0.25 .

From these data, it appears that there is significant genetic variability to justify selection for resistance to CRC. In fact, the full-sib nursery showed that gains in resistance from selection do occur. It also appears that phenotypic selection would be more effective as well as more efficient than half-sib methods.

Reference

- Byers, R.A., W.A. Kendall, R.N. Peaden, and D.R. Viands. 1996. Field and laboratory selection of *Medicago* plant introductions for resistance to the clover root curculio (Coleoptera: Curculionidae). *J. Econ. Entomol.* 89:1033-1039.
- Presho, G.R. 1975. Clover root curculio: Estimates of larval injury to alfalfa roots. *J. Econ. Entomol.* 68:61-65.